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NASA Scientists Use Hands-Off Approach to Land Passenger Jet

Imagine being able to land a jumbo jet without ever taking control of the stick. NASA scientists recently demonstrated the ability to control a 757 passenger jet simulation, using only human muscle-nerve signals linked to a computer.

Scientists outfitted the pilot with an armband implanted with eight electrodes. The sensors read muscle nerve signals as the pilot made the gestures needed to land a computer-generated aircraft at San Francisco International Airport in California. The pilot also demonstrated the ability to land a damaged aircraft during emergency landing drills.



Artist's Concept

"This is a fundamentally new way to communicate with machines — another way to talk with our mechanical world," said Dr. Charles Jorgensen, head of the neuroengineering laboratory at NASA's Ames Research Center. "This new technology is significant in that neuroelectric control of computers can replace computer keyboards, mice and joysticks for some uses," Jorgensen added.

"In the experiment, a pilot closes his fist in empty air, makes movements and creates nerve signals that are captured by a dry electrode array on his arm," said Jorgensen. "The nerve signals are analyzed and then routed through a computer, allowing the pilot to control the simulated airplane."

The pilot sees the aircraft and control panel projected on a large, dome-shaped screen while flying the aircraft. Engineers made the first prototype armband from exercise tights, and used metallic dress-buttons as dry electrodes.

"An advantage of using neuroelectric machine control is that human nerve signals can be linked directly with devices without the aid of joysticks or mice, thereby providing rapid, intuitive control," Jorgensen added. "This technology also is useful for astronauts in spacesuits who need to control tools in space."

Neuroelectric control uses "neural net" software that "learns" patterns that can slowly change and evolve with time, as well as combining many patterns together to generate a response. Nerve signal patterns, each of which is potentially as unique as a fingerprint, are a perfect application for neural net software. A particular nerve-signal pattern tells muscles to move in a certain way. A computer can match each unique nerve-signal pattern with a particular gesture, such as making a fist or pointing. Scientists designed software that can adjust for each pilot's nerve patterns, which can be affected by caffeine use, biorhythms, performance stress and the amount of fat under the skin.

To demonstrate bioelectric muscle control of the simulated 757 airplane during emergencies, researchers combined this technology with two other NASA developments, the ability of the neural net software to learn to fly damaged airplanes, and propulsion-only landing of aircraft.

In about one-sixth of a second, a computer onboard a damaged aircraft can "relearn" to fly a plane, giving the pilot better control. Severe damage, such as partially destroyed wings, fuselage holes or sensor failures greatly alter how an airplane handles and a pilot's controls may respond oddly or might not work at all, according to Jorgensen.

"When we combined the three technologies, the neuroelectrically wired pilot took the simulated aircraft into landing scenarios with a cascading series of accidents, first locking rudder controls and then progressing to full hydraulic failure," said Jorgensen. "For each case, successful landings were demonstrated for autopilot, damaged and propulsion-only control."

Images to illustrate this release are available at:
<http://amesnews.arc.nasa.gov/releases/2001/01images/bioelectric/bioelectric.html>

Wallops Shorts.....

Rocket Launches

NASA Terrier-Black Brant sounding rockets were successfully launched on Feb. 9 and 12 from the White Sands Missile Range, New Mexico. The first carried an optical astrophysics research experiment for Johns Hopkins University. Dr. Paul Feldman was the principal investigator. The second carried a microgravity research experiment for NASA Glenn Research Center. Dr. Howard Ross was the principal investigator. Both payloads were recovered.

On the Road

Dave Hancock, Observational Science Branch, and Owen Hooks, Occu-Health, Inc., recently took part in a Career Day event at Stephen Decatur Middle School.

Melanie Williams, Balloon Program Office; Tom Moskios, Safety Office; and Jan Jackson, PRC, served as judges for a Public Speaking Contest held at Chincoteague High School on February 13.

NASA Puts Education on the Fast Track

NASA is going to take students out for a spin, riding four-wide at speeds approaching 200 miles per hour. NASA's Marshall Space Flight Center has teamed with NASCAR's Jeff Gordon in a unique effort to get young minds interested in math and science education.

Gordon knows it takes more than skilled driving to win races. It takes a team with a vast field of knowledge, including technology, engineering, as well as math and science.

The three-time Winston Cup Champion agreed to work with the Agency and appear in a special education video "Patterns, Functions and Algebra: Wired for Space" - an installment of the NASA CONNECT series of instructional television programs available to educators and classrooms across the country.

"NASA CONNECT is an educational video series which enhances the teaching of math, science and technology concepts in grades 5 through 8," said Jim Pruitt, Manager of Marshall's Education Programs Department. "We also help teachers by giving them corresponding standards-based lesson plans to create a more interesting learning environment."

NASA College Scholarship

Applications for the NASA College Scholarship Fund are now available in the Public Affairs Office, Building F-6, Room 108.

The scholarship is open to all qualified dependents of NASA civil service employees, NASA retirees, and former NASA civil service employees or detailees.

Seven scholarships will be awarded in the amount of \$2,000 each. The renewable scholarship is for a maximum of \$8,000 over 6 calendar years. Applicants must be pursuing a course of study in a science or engineering field that will lead to a recognized undergraduate degree at an accredited college or university in the United States. The deadline for applications is March 30.



**March 9, 2001
8 p.m. - Midnight
Music by The Zydecats**

Cajun Food Catered
Tickets \$10 per person
For further information contact Bev Hall, x1714.

From FEDweek Feb. 14 issue C Fund Fighting Back

A 3.55 percent gain in January for the common stock (C) fund of the Thrift Savings Plan has moved that plan back close to the break-even point in the latest 12-month accounting of returns, with the fund showing a 0.93 percent loss over that counting period.

The bond (F) fund gained 1.65 percent during the month and the government securities (G) fund gained 0.46 percent, for 12-month returns of 13.9 and 6.32 percent, respectively. Meanwhile, money in the G fund is being invested at a 5.375 percent annual rate in February.



The National Society of Professional Engineers established National Engineers Week in 1951.

The week takes place each year at the time of George Washington's birthday. The nation's first president had the background of an engineer and land surveyor and established the first call for an engineering school, which led to the founding of West Point.

Multicultural Astronomy at the Visitor Center



Mike Savoy, Wallops Teacher on Loan, (right) dressed in native costumes to demonstrate how ancient Egyptians, Druids in the British Isles, as well as slaves traveling north on the Underground Railroad used astronomy and their knowledge of stellar objects for navigation. Wicomico County students (top) take part by "following the drinking gourd".



Black History Club Dinner with Entertainment

The Wallops Black History Club hosted its annual Dinner with Entertainment evening on Feb. 17, 2001. BHC Vice-President, David Smith, GHG, Inc., served as Master of Ceremonies.

comedian from the Washington, DC, area was featured. The evening concluded with a dance, music provided by Robert Tittle, Observational Science Branch.

James Purnell, local civil rights leader was the keynote speaker. Entertainment also was provided by local gospel soloists Kia Strand and Curtis Broadwater. Keisha Strand rendered two selections by harp. Kedar Ashaad,

Academic achievement awards were presented to the following students:

*Gregory Johnson, senior at Parkside High School

*Mitchell Nedab, freshman at the University of Virginia

*Candace Snow, freshman at the University of Maryland Eastern Shore and daughter of Carl Snow, GN&C Systems Engineering Branch.

*William Custis, Jr., freshman at the University of Maryland Eastern Shore and son of Justine Custis, Wharton Worldwide Service, Inc.

*Kristie Briddell, senior at Stephen Decatur High School

*Joshua Zant, senior at Parkside High School

Johnson, Nedab and Snow are former Summer High School Apprenticeship Research Program (SHARP) participants at NASA Wallops Flight Facility.

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